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(56) Documents Cited  
EP 1017209 A2 EP 0564127 A2  
WO 98/56221 A1 US 5430692 A

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(54) Abstract Title

Thermochromic housing for portable electronic device

(57) A housing for a portable electronic device, such as a mobile telephone handset or data processing apparatus, with a housing portion comprising a thermochromatic layer 10, which may reversibly change colour with temperature. The thermochromatic layer 10 comprises a thermochromatic component which may be a pigment, ink or dye. The housing portion may comprise part of a casing or a key. The thermochromatic layer 10 may also contain another thermochromatic component with different characteristics. The layer may also comprise non-thermochromatic components and may be patterned. Also described is a method of fabricating a housing portion with a thermochromic layer. Thermochromatic layer 10 is sprayed onto a substrate 8 and white base layer 9. A patterned layer 11,12 and finally a protective coating 13 are then sprayed on top of this.

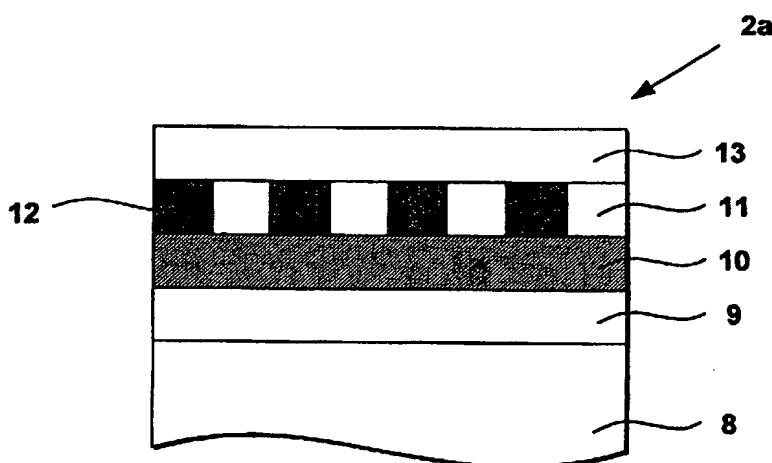


Figure 2

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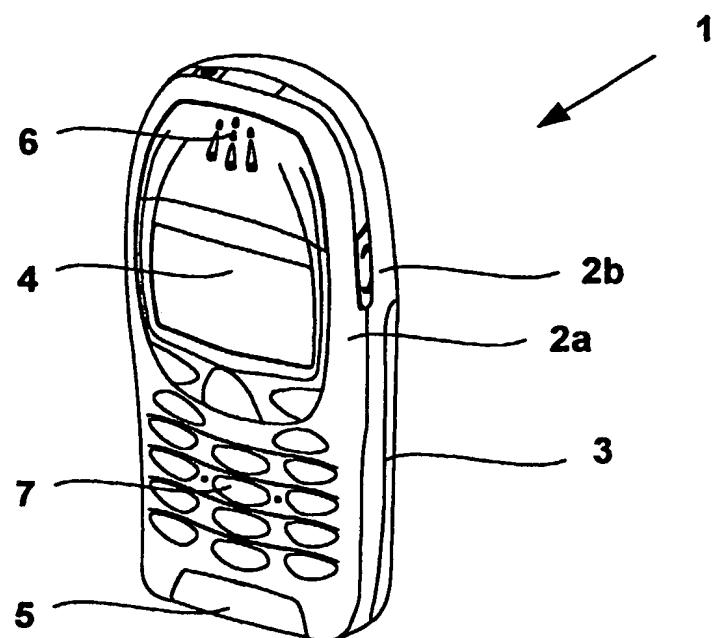


Figure 1

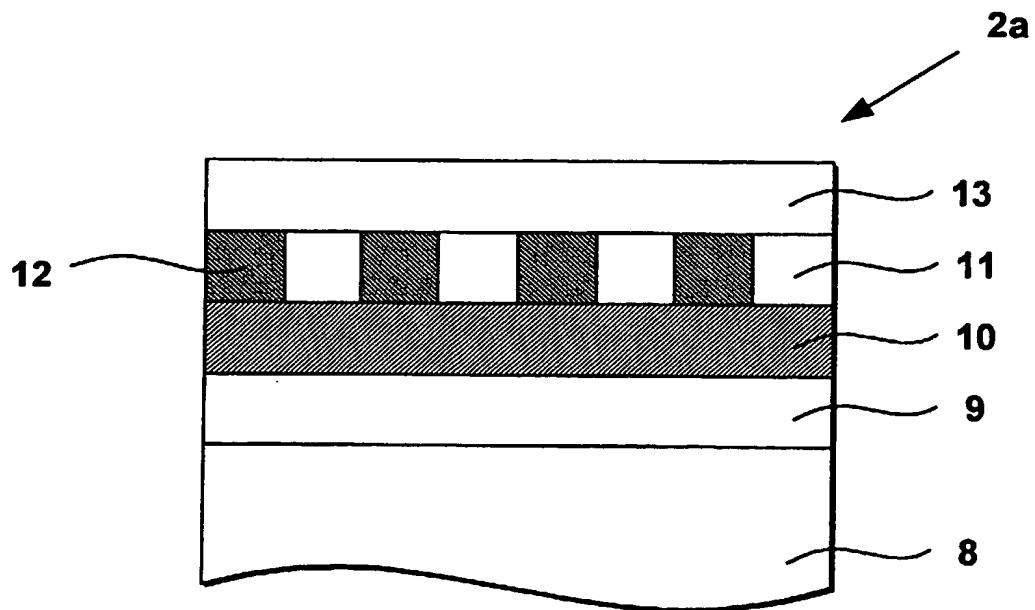


Figure 2

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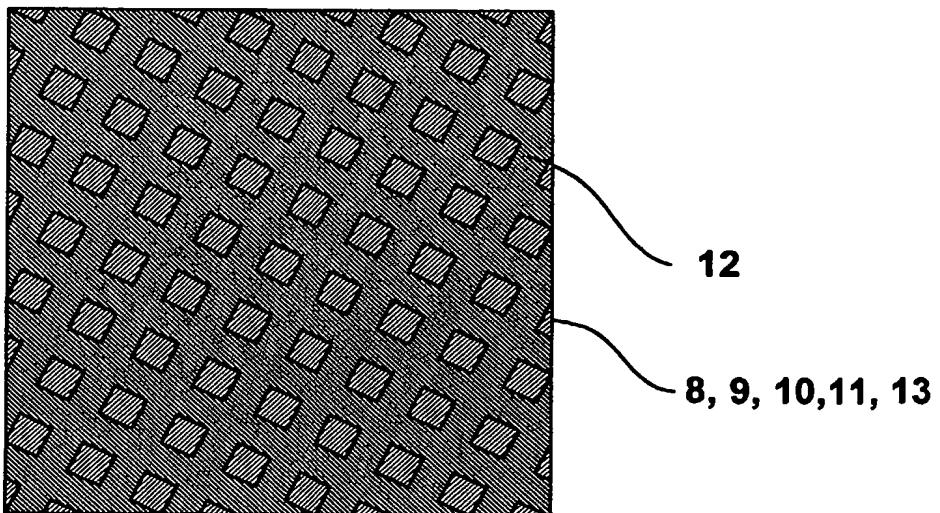


Figure 3

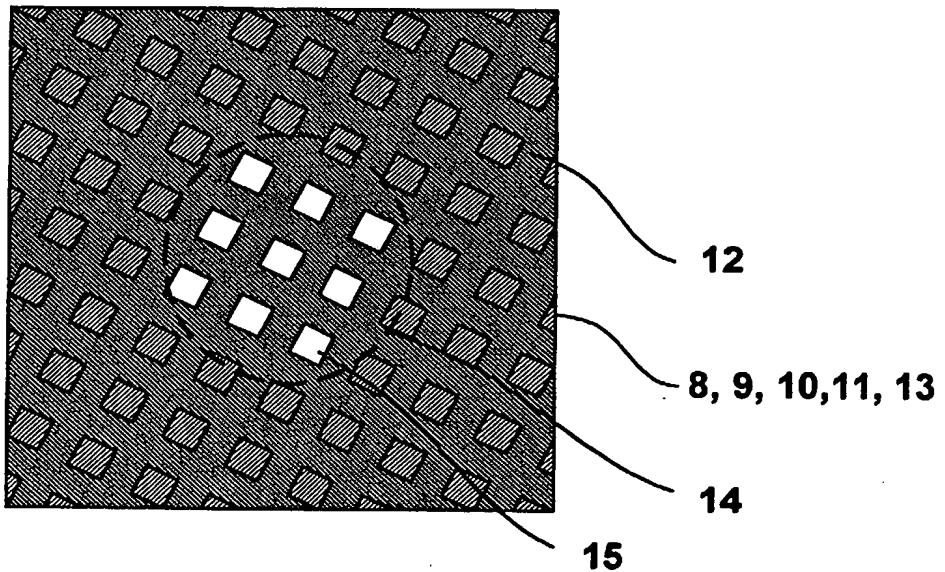


Figure 4

## Housing for portable electronic apparatus

### Description

The present invention relates to housing for portable electronic apparatus such as  
5 mobile phones and personal communicator handsets.

Manufacturers of products such as mobile telephone and personal communicator handsets often wish to increase the perceived quality of their products and to appeal to users who purchase products the appearance of which reflect their personality.

10 Decoration technologies usually involve patterning or colouring the housing of a product. However, the pattern or colour is fixed and cannot be altered easily or reversibly.

The present invention seeks to provide an improved housing.

According to the present invention there is provided a housing for portable electronic apparatus having a housing portion comprising a thermochromatic layer.

15 The thermochromatic layer may comprise a thermochromatic component, which may be a pigment, dye or ink.

The thermochromatic layer may be substantially coloured at a relatively low temperature and substantially colourless at a relatively high temperature. The thermochromatic layer may be relatively opaque at a relatively low temperature and 20 relatively translucent or transparent at a relatively high temperature. The relatively low temperature may be below 25 °C and the relatively high temperature may be above 25 °C.

25 The thermochromatic layer may further comprise another thermochromatic component and the thermochromatic components may have different colour transition temperatures.

The thermochromatic layer may further comprise non-thermochromatic pigment and may be patterned.

5       The housing portion may further comprise a patterned layer, which may be disposed over the thermochromatic layer and a protective layer, which may be translucent or transparent.

The thermochromatic layer may reversibly change colour with temperature.

The housing portion may comprise part of a casing or a key.

According to the present invention there is also provided a portable communications apparatus, such as a mobile telephone or communicator handset,  
10      incorporating said housing. The portable communications apparatus may be a computer.

According to the present invention there is also provided a data processing apparatus incorporating said housing.

According to the present invention there is also provided a method of fabricating a  
15      housing for a portable electronic apparatus, the method comprising providing a housing portion comprising a thermochromatic layer.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is perspective view of a mobile telephone according to the invention,  
20      Figure 2 is a cross-sectional view of layers comprising a housing portion,  
Figure 3 is a plan view of part of the housing portion shown in Figure 2 and  
Figure 4 is a plan view of part of the housing portion shown in Figure 3 which has been touched.

Referring to Figure 1, a mobile telephone handset 1 comprises a front housing portion 2a and a rear housing 2b including a battery pack 3, mobile telephone circuitry (not shown), a liquid crystal display (LCD) panel 4, microphone 5, ear-

piece 6, keypad 7 and antenna (not shown). The telephone circuitry is of the type, which is well known in the art, for example in the Nokia range of mobile telephones.

Referring to Figures 2 and 3, the front housing 2a comprises a moulded plastics substrate 8 covered on its outward-facing surface with a white base coat 9, a thermochromatic layer 10 which is sky blue when cold and transparent when hot, a patterned layer 11 having dark blue regions 12 and a clear protective layer 13. It will be understood by those skilled in the art that the term "thermochromic" may sometimes be used instead of "thermochromatic".

When cool, for example below 25 °C, the thermochromatic layer 10 is sky-blue and the front housing portion 2a appears as a dark blue weave with lighter blue regions in between. This gives the front housing portion 2a a denim fabric look, as shown in Figure 3.

When an area 14 of front housing 2a is touched, for example by a finger or palm of the hand, the underlying thermochromatic layer 10 is heated above a colour transition temperature, in this example 25 °C, when it becomes transparent. The area 14 of the front housing portion 2a that has been touched appears as a dark blue weave with white regions 15 in between, as shown in Figure 4. This gives the area 14 a faded denim fabric look. If the handset 1 is left to cool, the area 14 returns to the new denim appearance.

A method of manufacturing the front housing 2a will now be described.

The substrate 8 is moulded in a well-known manner from acrylonitrile butadiene styrene (ABS), although it will be appreciated that other plastics materials may be used. The base layer 9 is applied by spraying the substrate 8 with white pigmented single-pack acrylic urethane using a solvent-based carrier. Flash-off of the solvent is achieved at 60 °C, leaving the base layer 9 with a dry thickness of approximately 10µm.

The thermochromatic layer 10 is applied by spraying the base layer 9 with a blue thermochromatic pigment, such as a type-25, blue Chromicolor pigment available from Matsui International Co., Inc., Gardena, California, USA, diluted with a solvent. Flash-off of the solvent is achieved at 60 °C, leaving a thermochromatic  
5 layer having a dry thickness of approximately 10 µm. When cold, which in this case is below 25 °C, the thermochromatic layer 10 is blue and opaque. When hot, namely above 25 °C, the thermochromatic layer is substantially colourless and is either transparent or translucent.

The patterned layer 11 is applied by a cubic printing process and comprises a dark  
10 blue pigmented single-pack acrylic urethane. The pattern is defined and is suspended on surface of water. The substrate 8 with base layer 9 and thermochromatic layer 10 is dipped so as to transfer the floating pattern on top of the thermochromatic layer 10. The patterned layer 11 is cured at 60 °C and has a dry thickness of about 8 µm. It will be appreciated that the patterned layer 11 can  
15 be cured using UV light.

The protective coat 13 is applied using a spray and comprises a two-pack polyurethane clear coat base in a solvent. The protective coat 13 is cured at 60 °C and has a dry thickness of approximately 10 µm.

It will be appreciated that the front housing portion 2a may require further  
20 processing steps, for example adding labels and adding a clear cover for the LCD display 4.

It will be appreciated that many modifications may be made to the embodiment described above. For example, the different layer structures, colours of pigments, types of solvent and patterns may be used. For example, patterns may be chosen to  
25 give the housing the appearance of any surface found in the real world which a natural or man-made, such as patterns found in stone, wood or fabric. The pattern may be a picture. The thicknesses of each layer may vary. For example, thickness may lie in a range between 8 to 12 µm. The base and protective layers may be omitted. The thermochromatic pigment may be incorporated into the plastics

substrate. This may be achieved by mixing Chomicolour concentrates supplied by Matsui International Co. Inc. with the ABS resin before moulding. The thermochromatic pigment may have different colour transition temperatures. The thermochromatic layer may comprise a thermochromatic pigment and a non-  
thermochromatic pigment. At low temperature the colours of the thermochromatic pigment and non-thermochromatic pigment combine, for example blue and yellow respectively to give green. At higher temperature the thermochromatic pigment becomes transparent, thus producing a yellow appearance. The thermochromatic layer may itself be patterned. The housing portion comprising the thermochromatic layer may comprise the rear housing portion, part of the front or back housing portion or keys of the keypad. More than one thermochromatic layer may be included and each layer may have different colour transition temperatures. Different thermochromatic pigments with different colour transition temperatures may be combined in the same layer to give multiple colour transitions at different temperatures. For example, a change from blue to red occurs at 15 °C and from red to yellow at 25 °C. Rather than using a substrate made of plastic, metal substrates may also be used, for example made of pressed aluminium or magnesium. Both water- and solvent-based inks and pigments may be used and may be applied in different ways including in-mould, sublimation printing and tampa processes.

It will be appreciated that while the invention has been described in relation to mobile telephone handsets, it can be used with any sort of portable electronic apparatus, for example, hand held computers and portable measuring equipment.

**Claims**

1. A housing for portable electronic apparatus having a housing portion comprising a thermochromatic layer.
2. A housing according to claim 1, wherein the thermochromatic layer comprises thermochromatic component.  
5
3. A housing according to claim 2, wherein the thermochromatic component is a pigment.
4. A housing according to claim 2, wherein the thermochromatic component is an ink.
- 10 5. A housing according to claim 2, wherein the thermochromatic component is a dye.
6. A housing according to any preceding claim, wherein said thermochromatic layer is substantially coloured at a relatively low temperature and substantially colourless at a relatively high temperature.
- 15 7. A housing according to any one of claims 2 to 6, wherein the thermochromatic layer further comprises another thermochromatic component.
8. A housing according to claim 7, wherein thermochromatic components have different colour transition temperatures.
9. A housing according to any preceding claim, wherein said thermochromatic  
20 layer is relatively opaque at a relatively low temperature and relatively translucent at a relatively high temperature.
10. A housing according to claim 9, wherein said thermochromatic layer is transparent at the relatively high temperature.

11. A housing according to any one of claims 8 to 10, wherein the relatively low temperature is below 25 °C.
12. A housing according to any one of claims 8 to 10, wherein the relatively high temperature is above 25 °C.
- 5 13. A housing according to any preceding claim wherein said thermochromatic layer further comprises non-thermochromatic pigment.
14. A housing according to any preceding claim wherein the thermochromatic layer is patterned.
- 10 15. A housing according to any preceding claim wherein the housing portion further comprises a patterned layer.
16. A housing according to claim 15 wherein said patterned layer is disposed over said thermochromatic layer.
17. A housing according to any preceding claim wherein the housing portion further comprises a protective layer.
- 15 18. A housing according to claim 17 wherein the protective layer is translucent.
19. A housing according to claim 18 wherein the protective layer is transparent.
20. A housing according to any preceding claim wherein the thermochromatic layer reversibly changes colour with temperature.
21. A housing portion according to any preceding claim wherein the housing portion comprises part of a casing.
22. A housing according to any preceding claim wherein the housing portion is a key.

23. A housing for portable electronic apparatus substantially as hereinbefore described with reference to Figures 1 to 4 of the accompanying drawings.
24. A portable communications apparatus incorporating said housing as claimed in any preceding claim.
- 5 25. A portable communications apparatus according to claim 24, which is a mobile telephone handset.
26. A portable communications apparatus according to claim 24, which is a personal communications handset.
- 10 27. A portable communications apparatus according to any one of claim 24 to 26, which is a computer.
28. A data processing apparatus incorporating said housing as claimed in any preceding claim.
- 15 29. A method of fabricating a housing for a portable electronic apparatus, the method comprising providing a housing portion comprising a thermochromatic layer.



Application No: GB 0028573.4  
Claims searched: All

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Examiner: Geoff Holmes  
Date of search: 22 June 2001

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK Cl (Ed.S): H4J (JK)  
Int Cl (Ed.7): H04M 1/02  
Other: Online: WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	EP 1017209 A2 [NOKIA] whole document relevant	1 at least
A	EP 0564127 A2 [AMERICAN TELEPHONE]	
A	WO 98/56221 A1 [R-DESIGN]	
X	US 5430692 A [GRUPP et al] whole document relevant	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.